B Hoffman

US Army Corps
of Engineers
Rock Island District

OPERATION AND MAINTENANCE MANUAL
BIG TIMBER REFUGE
REHABILITATION AND ENHANCEMENT

UPPER MISSISSIPPI RIVER
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 17
RIVER MILE 443-445
LOUISA COUNTY, IOWA

JUNE 1994

BIG TIMBER REFUGE REHABILITATION AND ENHANCEMENT
OPERATION AND MAINTENANCE MANUAL

UPPER MISSISSIPPI RIVER ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 17, RIVER MILE 443 THROUGH 445
LOUISA COUNTY, IOWA

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1. INTRODUCTION

a. Purpose and Scope.

(1) This manual has been prepared to serve as a guide for the operation and maintenance of Big Timber Refuge Rehabilitation and Enhancement. Operations and maintenance instructions for the major features of the project are presented. The instructions are consistent with the general procedures presented in the Definite Project Report. This manual has been written for project and management personnel familiar with the project and does not contain detailed information which is common to site personnel or which is presented in other existing manuals or regulations.

(2) The intent of the operating instructions is to provide information which allows orderly and efficient use of the constructed features to meet project goals and objectives. The intent of the maintenance instructions is to present preventative maintenance information consisting of systematic inspections and subsequent corrective actions which should ensure long-term utilization of equipment and features. A timely preventative maintenance program reduces and virtually eliminates breakdown of essential equipment and prevents major damage to constructed features by early corrective action.

(3) This manual provides the general standards of maintenance and establishes an initial frequency of maintenance inspections which should ensure satisfactory project performance.

b. Use of Manual.

(1) This manual is divided into the following section: Section 2: Historical Summary; Section 3: Description of Project Features; Section 4: Inspections; Section 5: Operation and Maintenance of Project Features; and Section 6: Performance Monitoring and Assessment. Section 2 and 3 present historical summaries and descriptions of actual features constructed for this project. Section 4 presents project inspection procedures and Section 5 presents operation and maintenance instructions for each project feature.

(2) Section 6 provides a summary of monitoring activities conducted through construction and provides an overview of continued monitoring actions. Performance monitoring is considered necessary to properly evaluate effects of the constructed project features.

(3) The attached drawings have been included to provide general project "as-built" views, typical sections, and plans.

2. HISTORICAL SUMMARY.

a. Authorization and Location.

(1) The authority for this project was provided by the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resource Development Act of 1986, Public Law 99-662. The project was funded and constructed under this authorization by the U.S. Army Corps of Engineers, Rock Island District, in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the State of Iowa, Department of Natural Resources (IDNR).

(2) The Big Timber Refuge Area is located on the west bank of pool 17, approximately 10 river miles south of Muscatine, Iowa. The project features lie entirely within the area of lands acquired by the Corps of Engineers for the Mississippi River Nine-Foot Navigation Channel project. This area is managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Mark Twain National Wildlife Refuge.

b. Planning and Construction Activities.

(1) Table 2-1 provides a summary of planning and construction activities.

Table 2-1

SUMMARY OF PLANNING AND CONSTRUCTION ACTIVITY

Project Phase	Responsible Purpose	Agency	Significant Events Item	Date	Remarks
Pre-Project	Identify and define problems establish need of project.	USFWS	Fact Sheet Submitted to Corps	Mar 87	--
			Approved by Corps	Nov 87	--
Design	Quantify project objectives, perform preliminary design satisfy NEPA and permit requirements, develop performance evaluation plan, obtain project approval for construction	CORPS	Definite Project Report		
			Draft	Dec 88	--
			Final	Jul 89	--
			Approved	Sep 89	--
			NEPA Compliance		
			SHPO Concurrance	Dec 88	--
			Public Review	Apr 89	--
			FONSI for EA	Jul 89	1/
			Permits		
			Section 410	Jan 89	--
			Section 404	Jul 89	--
			Refuge Compatibility	Jan 89	--
Construction	Finalize plans and specifications, obtain operation and maintenance agreement, advertise and award construction contract, construct project.	CORPS	Plans and Specifications		
			Final	Oct 89	--
			Approved	Nov 89	--
			Real Estate		
			Agreement from USFWS to issue Right-of-Entry permit	May 89	--
			O&M Agreement	Nov 89	Reference Appendix A

Table 2-1

SUMMARY OF PLANNING AND CONSTRUCTION ACTIVITY

Project Phase	Responsible Purpose	Agency	Significant Events Item	Date	Remarks
			Dredging Contract		
			Advertised	Nov 89	--
			Awarded	Jan 90	--
			Substantially Complete	Sep 91	
			Revegetation Construction		
			Advertised	Nov 93	--
			Awarded	Jun 93	--
			Scheduled Complete	Oct 94	
Post-Construction	Operate & maintain project	USFWS & IDNR	--	--	Reference Sections 4 and 5
	Perform evaluation monitoring	CORPS	--	--	Reference Section 6

Notes:

1/ A FONSI was completed by both the Corps and the USFWS.

(2) Goals and objectives were formulated during the design phase. Table 2-2 provides a summary of project objectives.

Table 2-2
PROJECT OBJECTIVES

Goal	Objective	Project Feature
Enhance Aquatic Habitat	Restore deep (6 ft) aquatic habitat	Hydraulic Dredging
	Restore shallow aquatic habitat	Mechanical Excavation
	Provide year-round habitat access (cross sectional area)	Dredging & Excavation
	Improved dissolved oxygen concentration during critical seasonal stress periods	Dredging & Excavation
Enhance Terrestrial Habitat	Produce tree dominated areas	Revegetation
Enhance Migratory Waterfowl Habitat	Increase reliable nesting & feeding water areas	Pothole Creation & Dredging/Excavation
	Provide isolated resting, feeding and breeding pools	Pothole Creation

(3) The project was designed by the Rock Island District, Corps of Engineers in cooperation with the USFWS and the IDNR. Design considerations and investigations are presented in the Definite Project Report. The construction contract was supervised by the Corps of Engineers, Rock Island District.

(4) A construction contract, number DACW25-90-C-0040, was awarded to J.F. Brennan Co., LaCrosse, Wisconsin, on 22 May 1990 in the amount of $651,645.00. This bid was approximately 77% of the official Government Estimate. This includes all work except revegetation which will be completed in FY 94. The revegetation contract number DACW25-93-C-0034, was awarded to Geode Resource, Conservation & Development, Incorporated, Burlington, Iowa on 2 June 1993 in the amount of $45,598.60. The bid was approximately 127% of the government estimate

(5) The disturbed area seeding portion of the contract was deleted after it was determined that thick vegetative cover was established shortly after construction without seeding. This item reduced the construction cost by $100,427 making the revised contract cost $551,218.00.

(6) Creating potholes that had standard dimensions as originally conceived was impractical. Actual pothole dimensions varied from 24 to 50 feet in width and from 60 to 80 feet in length. The depth of the potholes ranged from 5 to 11 feet below the ground surface. These dimensions were determined by refuge personnel to provide greater habitat value due to greater diversity.

c. Actual Project Costs. The actual cost of the project are presented in Table 2-3.

Table 2-3

ACTUAL PROJECT COST

CE Feature Code Number

06. FISH AND WILDLIFE FACILITIES

CONTRACT NO. DACW25-90-C-0040

CONTRACT ITEM NUMBER	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
01	Temporary Field Office	1	LS	$ 15,000.00	$ 15,000.00
02	Clearing & Grubbing	1	LS	$ 135,340.00	$ 135,340.00
03	Removal & Disposal of Stumps				
)3A	First 20 Each	20	EA	$ 100.00	$ 2,000.00
03B	Over 20	110	EA	$ 100.00	$ 11,000.00
04	Hydraulic Dredging, A Thru B	20,200	CY	$ 2.10	$ 31,215.45
05	Mechanical Excavation B Thru C	8,130	CY	$ 2.56	$ 13,973.76
06	Mechanical Excavation D Thru G & E Thru F	18,400	CY	$ 2.37	$ 81,123.68
07	Mechanical Excavation C Thru D & D Thru E	39,600	CY	$ 2.38	$ 70,295.44
08	Hydraulic Dredging, C Thru D & D Thru E	74,070	CY	$ 2.10	$ 123,660.00
09	Ponds	10	EA	$ 2,866.00	$ 28,660.00
10	Seeding (DELETED)	1	LS	$ 0.00	$ 0.00
11	Adjusted quantites	1	LS	$ 7,847.44	$ 7,847.44
. FISH AND WILDLIFE FACILITIES			SUBTOTAL		$ 520,128.34

Table 2-3

ACTUAL PROJECT COST

CE Feature Code Number

06. FISH AND WILDLIFE FACILITIES

CONTRACT NO. DACW25-93-C-0034

CONTRACT ITEM NUMBER	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
01	Mobilization	1	LS	$ 2,327.00	$ 2,327.00
02	Northern Red Oak	50	EA	$ 50.50	$ 2,525.00
03	Pin Oak	50	EA	$ 50.05	$ 2,502.50
04	Swamp White Oak	50	EA	$ 50.50	$ 2,525.00
05	Bur Oak	50	EA	$ 49.50	$ 2,475.00
06	Bitternut Hickory(not selected)	50	EA	$ 0.00	$ 0.00
07AA	Northern Red Oak	16	EA	$ 50.50	$ 808.00
07AB	Pin Oak	16	EA	$ 50.05	$ 800.80
07AC	Swamp White Oak	18	EA	$ 50.50	$ 909.00
08	ShellBark Hickory(not selected)	50	EA	$ 0.00	$ 0.00
09AA	Northern Red Oak	16	EA	$ 50.50	$ 808.00
09AB	Pin Oak	16	EA	$ 50.05	$ 800.80
09AC	Swamp White Oak	18	EA	$ 50.50	$ 909.00
10	Northern Pecan	50	EA	$ 55.25	$ 2,762.50
11	Sycamore	50	EA	$ 55.00	$ 2,750.00
12	Black Walnut	50	EA	$ 38.50	$ 1,925.00
13	Common Chokeberry	75	EA	$ 44.00	$ 3,300.00
14	Gray Dogwood	75	EA	$ 33.28	$ 2,496.00
15	Pagoda Dogwood	75	EA	$ 38.50	$ 2,887.50

Table 2-3

ACTUAL PROJECT COST

CE Feature
Code Number

06. FISH AND WILDLIFE FACILITIES

CONTRACT

ITEM NUMBER	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
16	Shadblow Serviceberry	75	EA	$ 34.50	$ 2,587.50
17	American Filbert	75	EA	$ 35.75	$ 2,681.25
18	Highbush Cranberry	75	EA	$ 41.25	$ 3,093.75
19	Spring Herbicide Treatment	1	LS	$ 1,800.00	$ 1,800.00
20	Fall Herbicide Treatment	1	LS	$ 1,925.00	$ 1,925.00
06. FISH AND WILDLIFE FACILITIES			SUBTOTAL		$ 45,598.60
				TOTAL	$ 565,726.94
30. PLANNING, ENGINEERING AND DESIGN					$ 104,000.00*
31. CONSTRUCTION MANAGEMENT					$ 62,000.00*
				TOTAL PROJECT COSTS	$ 731,762.94

* Costs do not include a final accounting for cost related to engineering or construction management during the revegetation contract.

d. Project References. Table 2-4 provides a summary of related project references.

Table 2-4

PROJECT REFERENCES

Title	Date	Purpose
Definite Project Report, Big Timber Refuge Rehabilitation & Enhancement, U.S. Army Corps of Engineers, Rock Island District	July 1989	Provided planning engineering, and sufficient construction details of the selected plan for project approval purposes.
Construction As-Builts	June 1992	Provided as-built construction drawings

3. DESCRIPTION OF PROJECT FEATURES.

a. Project Data. Table 3-1 presents a summary of project data.

Table 3-1

PROJECT DATA SUMMARY

Confined Dredged Material Placement Site		
Containment Levee	6,400	feet
Average Material Depth	1.8	feet
Area	73	acres
Capacity	157,000	cubic yards
Hydraulic Dredging		
Volume	73,757	cubic yards
Typical Invert	528	MSL
Mechanical Excavation		
Volume	69,224	cubic yards
Typical Invert	533	MSL
Check Dams		
Number	4	MSL
Approximate Elevation	543	MSL
Potholes		
Number	10	
Dimensions	40 x 70	feet
Depth	8	feet
Revegetation		
Buttonbush	450	bushes
Hardwood Trees	450	trees

b. Confined Dredged Material Placement Site.

(1) A confined dredged material placement site (CPS) was constructed to contain the dredged material from Big Timber Refuge. The construction consisted of the placement of a clay dike along the banks of Big and Little Denny to an elevation of 544 MSL. This along with the natural bank along the Mississippi River of approximately 544.0 MSL formed a natural dish. See location on Drawing C-1.

(2) The approximate size of this area is 73 acres with a perimeter of approximately 9,200 feet. The original surface had an average elevation of approximately 540.0 MSL. The average top elevation of the dredged material is 541.5 MSL.

c. Hydraulic Dredging. Big Timber Refuge was dredged to restore and provide additional back water complex aquatic habitat. Over-winter and summer thermal refuge area for fish were restored. The bottom width of the dredging was 35 feet with a bottom elevation of 528 MSL or 9.0 feet below flat pool.

d. Mechanical Excavation. Big Timber Refuge was mechanically excavated to restore and provide additional back water complex aquatic habitat. It will increase fish spawning and nursery habitat. In selected areas, adjacent to the hydraulic dredging, mechanical excavation was performed to elevation 533 MSL (4 feet below flat pool) with a 40 to 50 foot bottom width. In addition, the Timber Chute area was mechanically excavated (rather than hydraulically dredged) to elevation 528 MSL with a 35 foot wide channel. Cleared timber was placed in the finished channel at several locations including the entrace to Little Denny.

e. Check Dams. In areas where mud flats were encroaching on existing ponds or channels, the mechanically excavated material was placed along the bank of the mud flat. Check dams were constructed at those locations where overland flood flows were depositing sediment at the project site.

f. Pothole Creation. Explosives were used to blast openings in the mud flats where willows were encroaching. These holes have filled with water and will provide secluded open water for duck broods for resting, feeding, and breeding.

g. Revegetation.

(1) Within the CPS replanting of trees (hickory and oak) will occur on the containment dike which was determined to have the greatest likelyhood of success due to being the highest elevation in the area. In addition, 2.5 acres of buttonbush will be planted.

4. INSPECTIONS.

a. General.

(1) An active maintenance program is based on inspections and subsequent servicing, adjustment, or repair. There are 2 main objectives of inspections: (1) to insure project serviceability by timely and thorough inspections thereby avoiding or reducing maintenance costs, and (2) to document the condition of the project as a baseline for consideration of rehabilitation for project damage resulting from a major storm or flood event.

(2) There are two types of inspections for the project: (1) Project Inspection by the Site Manager and (2) Joint Inspection by the Site Manager and personnel from the Corps of Engineers, Rock Island District.

b. Project Inspection by Site Manager.

(1) The Project Inspection will be performed by the Site Manager (the USFWS Refuge Manager) or appropriate representative for the purpose of noting routine deficiencies and initiating corrective actions. This inspection will be performed at periods not exceeding 12 months and will follow inspection guidance presented in subsequent sections of this manual. It is suggested that the inspection be conducted every May, which is representative of after spring flood conditions. Other Project

Inspections should occur as necessary after other high water events or as scheduled by the Site Manager.

(2) A Project Inspection checklist has been developed as presented in Appendix B. A copy of the completed checklist will be furnished to the Corps of Engineers, Rock Island District, ATTN: CENCR-OD-S, P.O. Box 2004, Rock Island, Illinois 61204-2004, immediately following each Project Inspection by the Site Manager.

c. Joint Inspection by Site Manager and Corps of Engineers.

(1) Routine. A Joint Inspection by the Site Manager and the Corps of Engineers will be scheduled by the Corps in accordance with ER 1130-2-339. The inspection will follow the Project Inspection checklist presented in Appendix B. The purpose of this inspection is to assure that adequate maintenance is being performed as presented in the DPR and this manual. The District Engineer or authorized representatives should have access to all portions of the constructed project upon coordination with the Site Manager for this purpose. Copies of this inspection will be furnished to the Site Manager stating project maintenance conditions. Corrective actions from these inspections should be accomplished by the Site Manager as provided by USFWS Operation, Maintenance, and Rehabilitation Agreement, reference appendix A.

(2) Catastrophic. A Joint Inspection by the Site Manager and the Corps of Engineers should be formally requested by the Site Manager immediately following a specific storm or flood event which causes damage exceeding the annual operation and maintenance as specified in this manual and the Definite Project Report. A comparison of the pre- and post-event Project Inspections and the Joint Inspections will be the basis for determining maintenance responsibility and potential rehabilitation by the Corps of Engineers.

5. OPERATION AND MAINTENANCE OF PROJECT FEATURES.

a. General.

(1) This section presents operation and maintenance instructions for the major project features which were designed and constructed to minimize operation and maintenance requirements.

(2) Steps will be taken by the Site Manager to correct conditions disclosed by Project Inspections or Joint Inspections. Regular maintenance repair measures will be accomplished during the appropriate season as scheduled by the Site Manager to insure serviceability.

(3) Project features should be continuously maintained and operated to obtain maximum benefits. No encroachment or trespass which will adversely affect the efficient operations or maintenance of the project should be permitted upon the constructed features, nor should any excavation or construction be permitted within these features without prior approval by the Corps of Engineers, Rock Island District. Such improvements or alterations which are desirable and permissible should be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice should be obtained from the District Engineer or if otherwise obtained, should be submitted for approval. Drawings or prints showing improvements or alterations as finally constructed should be furnished to the District Engineer after completion of such work.

b. Confined Dredged Material Placement Site.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager.

(2) Maintenance. Project inspections of the dredged material placement site will be made by the Site Manager for waste materials and unauthorized structures.

c. Hydraulic Dredging.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager.

(2) Maintenance. Project inspections of the Little Denny entrance access control will be made by the Site Manager for debris removal and placement. In addition, dredged back water channels will be inspected for waste materials, and unauthorized structures.

d. Mechanical Excavation.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager.

(2) Maintenance. Project inspections of the Little Denny entrance access control will be made by the Site Manager for debris removal and placement. In addition, excavated channels will be inspected for waste materials, and unauthorized structures.

e. Check Dams.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager.

(2) Maintenance. Project inspections of the check dams will be made by the Site Manager for waste materials, and unauthorized structures.

f. Pothole Creation.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager.

(2) Maintenance. Project inspections of the potholes will be made by the Site Manager for waste material and unauthorized structures.

g. Revegetation.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager.

(2) Maintenance. Project inspections of the revegetated area will be made by the Site Manager for proper seedling care including herbicide treatment.

6. PERFORMANCE MONITORING AND ASSESSMENT

a. General. The purpose of this section is to summarize monitoring and data collection aspects of the project. Table 6-1 presents the principal types, purposes, and responsibility of monitoring and data collection. Table 6-2 provides a summary of actual monitoring and data parameters grouped by project phase, responsible agency, and data collection intervals. Changes to the monitoring plan should be coordinated with the USFWS, IDNR, and COE.

b. Post Performance Evaluation Plan. Table 6-3 presents the post-construction evaluation plan. The monitoring parameters were developed to measure the effectiveness of the stated goals. The Site Manager should follow Table 6-3, as shown, to make annual field observations. These observations are summarized in checklist form in Appendix B. The annual field observations and the quantitative monitoring parameters will form the basis of project evaluation.

TABLE 6-1

MONITORING AND PERFORMANCE EVALUATION MATRIX

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementation Instructions
Pre Project	Sedimentation Problem Analysis	System-wide problem definitation. Evaluate planning assumptions.	USFWS	USFWS (EMTC)	LTRM 1/	--
	Pre-project Monitoring	Identifies and defines problems at HREP site. Establish need of proposed project features.	USFWS	USFWS	USFWS	--
	Baseline Monitoring	Establishes baselines for performance evaluation	Corps	Corps	LTRM	See Table 6-2
Design	Data Collection for Design	Includes quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP 1/	See Table 6-2
Construction	Construction Monitoring	Assess construction impacts; assures permit conditions are met	Corps	Corps	HREP	See State Section 401 Stipulations
Post	Performance Evaluation Monitoring	Determine success of project as related to objectives	Corps(quantitative) sponsor (Field Observation)	Corps USFWS	LTRM	See Table 6-3
	Analysis of Biological Responses to Projects	Evaluate predictions and assumptions of habitat unit analysis Studies beyond scope of performance evaluation, or if projects do not have desired biological results. *	USFWS	USFWS (EMTC)	LTRM	--

1/ Long Term Resource Monitoring of the Environmental Management Program (P.L. 99-662)

2/ Habitat Rehabilitation and Enhancement Project of the Environmental Management Program (P.L. 99-662)

TABLE 6-2

RESOURCE MONITORING AND DATA COLLECTION SUMMARY 1/

	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA			
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
Type Measurement	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR							Sampling Agency
Remarks													
POINT MEASUREMENTS													
Water Quality Station W-M443.6G 2/													CCE
Turbidity	2W		2W		2W	M							
Secchi Disk Transparency	2W		2W		2W	M							
Suspended Solids	2W		2W		2W	M							
Dissolved Oxygen	2W		2W		2W	M							
Specific Conductance	2W		2W		2W	M							
Water Temperature	2W		2W		2W	M							
pH	2W		2W		2W	M							
Total Alkalinity	--		--		2W	M							
Chlorophyll	2W		2W		2W	M							
Velocity	--		--		2W	M							
Water Depth	2W		2W		2W	M							
Water Elevation	2W		2W		2W	M							
Percent Ice Cover						M							
Ice Depth						M							
Percent Snow Cover						M							
Snow Depth						M							
Wind Direction					2W	M							
Wind Velocity					2W	M							
Wave Height					2W	M							
Air Temperature					2W	M							
Percent Cloud Cover					2W	M							

TABLE 6-2

RESOURCE MONITORING AND DATA COLLECTION SUMMARY 1/

	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA		
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase
Type Measurement	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR						
Remarks												
POINT MEASUREMENTS												
Sediment Test Stations 3/												
Elutriate			1									
Bulk Sediment			1									
Column Settling Stations 4/												
Column Settling Analysis								1				
Boring Stations 5/												
Geotechnical Borings								1				

TABLE 6-2

RESOURCE MONITORING AND DATA COLLECTION SUMMARY 1/

Type Measurement / Remarks	WATER QUALITY DATA			ENGINEERING DATA			NATURAL RESOURCE DATA			Sampling Agency
	Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
	APR-SEP OCT-MAR	APR-SEP OCT-MAR	APR-SEP OCT-MAR							
TRANSECT MEASUREMENTS										
Sedimentation Transects 6/										
Hydrographic Soundings				1						
Sedimentation Transects 7/										
Hydrographic Sounding						5Y				
Vegetation Transects 8/										
Mast Tree Survey									5Y	
AREA MEASUREMENTS										
Mapping 9/										
Areal Photography							1		5Y	

LEGEND

W = Weekly

M = Monthly

Y = Yearly

nW = n-Week interval

nY = n-Year interval

1, 2, 3, --- = number of time data is collected within designated project phase

TABLE 6-3

POST CONSTRUCTION EVALUATION PLAN

Enhancement Potential

Goal	Objective	Alternative	Enhancement Feature	Unit	Year 0 Without Alternative	Year X With Alternative	Year 50 Target With Alternative	Feature Measurement Reference Table 6-2	Annual Field Observations by Site Manager
Enhance Aquatic Habitat	Restore deep (6 feet) aquatic habitat	Big Timber dredging	Hydraulic dredging	AC-FT	0	--	100	Perform hydrographic soundings of transects 7/	Development of emergent vegetation within deep dredged areas
	Restore shallow aquatic habitat	Big Timber dredging	Mechanical excavation	AC-FT	0	--	30	Perform hydrographic soundings of transects 7/	Encroachment of bank or obvious shoaling in shallow dredged areas
	Improve levels of dissolved oxygen during critical seasonal stress periods	Big Timber dredging/ excavation	Dredging/ excavation	Mg/L	0	--	5.0	Perform water quality tests at Station W-M443.6G	Fish stress (at surface) or fish kills
	Provide year-round habitat access cross-sectional area	Big Timber dredging/ excavation	Dredging/ excavation	Sq Ft	0	--	500	Perform hydrographic soundings of transect 7/ access area	Development of emergent vegetation within

TABLE 6-3 (Cont'd)

POST CONSTRUCTION EVALUATION PLAN

Enhancement Potential

Goal	Objective	Alternative	Enhancement Feature	Unit	Year 0 Without Alternative	Year X With Alternative	Year 50 Target With Alternative	Feature Measurement Reference Table 6-2	Annual Field Observation by Site Manager
Enhance Terrestrial Habitat	Produce mast tree dominated areas	Mast tree plantings on dredged material placement site	Revegetation	Acres of mast trees	170	--	204	Perform vegetation transects in mast tree area 8/	Seedling survival
Enhance Migratory Waterfowl Habitat	Increase reliable resting and feeding water areas	Blasting of potholes and dredging/excavation with constructed access limitation	Pothole creation and dredging/ excavation	AC	0	--	21	Perform hydrographic soundings of transect 7/. Perform areal survey of project area 9/	Waterfowl presence or absence
	Provide isolated resting, feeding and breeding pools	Blasting of potholes	Pothole creation	EA	0	--	10	Perform areal survey of project area 9/	Waterfowl presence or absence

1/ Post Construction monitoring sites/transects are shown on drawing MP-1. See DPR for Pre-Project and Design Phase station locations.

2/ Water Quality Station

W-M443.6G DPR D-1

3/ Sediment Test Stations (Design Phase)

DPR - BT-1
DPR - BT-2
DPR - BT-3
DPR - BT-4

4/ Column Settling Station (Design Phase)

DPR - BT-88-2-1
DPR - BT-88-2-2

5/ Boring Stations (Design Phase)

DPR BT-88-1 through BT-88-9

6/ Sedimentation Transects (Pre-Project Phase)

DPR Tranverse with 27 cross-sections

7/ Sedimentation Transects (Post Construction Phase)

S-M443.7F to S-M443.6G
S-M443.7G to S-M443.5H
S-M443.7J to S-M443.6J
S-M443.7J to S-M443.7K
S-M443.8J to S-M443.8K
S-M444.0J to S-M444.0K
S-M444.2J to S-M444.2K
S-M444.3I to S-M444.4K
S-M444.4H to S-M444.5H
S-M444.7G to S-M444.7H
S-M444.8H to S-M444.8I

8/ Vegetation Transects (Post Construction Phase)

V-M444.5J to V-M444.5M
V-M444.7I to V-M444.7M

Mast tree survey of hardwood trees planted in the dredged material confined placement site.

Sampling locations will be at equal 1/3 increments on each vegetative range. Excluding range end points, sampling will be every 300 feet on the upstream range and every 200 feet on the downstream range for a total of 6 points, 3 on each range.

9/ Mapping (Post Construction Phase)

Areal survey will be performed of the project area to determine the amount of waterfowl resting and feeding water areas and to inventory potholes.

The following monitoring was performed by the construction contractor during the construction phase for the purpose of meeting permit requirements.

Station	Frequency
Outlet Wier	
Suspended Solids	Daily
Temperature	Daily
pH	Daily
Ammonia Nitrogen	Daily
Upstream of Outlet Wier	
Suspended Solids	Daily
Temperature	Daily
pH	Daily
Ammonia Nitrogen	Daily
100 Feet Downstream of Above Point	
Suspended Solids	Daily
Temperature	Daily
pH	Daily
Ammonia Nitrogen	Daily

APPENDIX A

OPERATION, MAINTENANCE AND REHABILITATION AGREEMENT

MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES FISH AND WILDLIFE SERVICE
AND
THE DEPARTMENT OF THE ARMY
FOR
ENHANCING FISH AND WILDLIFE RESOURCES
OF THE
UPPER MISSISSIPPI RIVER SYSTEM
AT BIG TIMBER REFUGE, IOWA

I. PURPOSE

The purpose of this Memorandum of Agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (FWS) and the Department of the Army (DA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Big Timber Refuge, Iowa, separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features at Big Timber Refuge are 100 percent Federal, and all operation, maintenance, repair, and rehabilitation costs are to be cost shared, 75 percent Federal and 25 percent non-Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of creating 100 acre-feet of deep water and 30 acre-feet of shallow aquatic habitat, restoring 500 square feet of access between aquatic habitats, increasing mast tree dominated area by 30 acres, providing 21 acres of reliable resting and feeding water area, and creating 10 isolated nesting and feeding pools.

IV. RESPONSIBILITIES

A. DA is responsible for:

1. Construction: Construction of the project which consists of creating 100 acre-feet of deep water and 30 acre-feet of shallow aquatic habitat, restoring 500 square feet of access between aquatic habitats, increasing mast tree dominated area by 30 acres, providing 21 acres of reliable resting and feeding water area, and creating 10 isolated nesting and feeding pools.

2. Major Rehabilitation: Any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. Construction Management: Subject to and using funds appropriated by the Congress of the United States, DA will construct the Big Timber Refuge Fish and Wildlife Enhancement Project as described in the Definite Project Report, "Big Timber Refuge Rehabilitation and Enhancement," dated July 1989, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The FWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If DA encounters potential delays related to construction of the project, DA will promptly notify FWS of such delays.

4. Maintenance of Records: DA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. DA shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the project and resolution of all relevant claims arising therefrom, and shall make available at its offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the FWS.

B. FWS is responsible for:

1. Operation, Maintenance, and Repair: Upon completion of construction as determined by the District Engineer, Rock Island, the FWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report entitled "Big Timber Refuge Rehabilitation and Enhancement," dated July 1989, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

2. Non-Federal Responsibilities: In accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662, the FWS shall obtain 25 percent of all costs associated with the operation and maintenance of the project from the Iowa Department of Natural Resources.

V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of construction of the project.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties:

FWS: Regional Director
U.S. Fish and Wildlife Services
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

DA: District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

VII. EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

BY: John R. Brown
JOHN R. BROWN
Colonel
U.S. Army Engineer District,
Rock Island
Corps of Engineers

DATE: 18 October 1989

THE U.S. FISH AND WILDLIFE SERVICE

BY: for
JAMES C. GRITMAN
Regional Director
U.S. Fish and Wildlife
Service

DATE: 9/18/89

APPENDIX B

SITE MANAGER'S

PROJECT INSPECTIONS AND MONITORING RESULTS

BIG TIMBER REFUGE REHABILITATION AND ENHANCEMENT
OPERATION AND MAINTENANCE MANUAL

UPPER MISSISSIPPI RIVER ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 16, RIVER MILE 443 THROUGH 445
LOUISA COUNTY, IOWA
SITE MANAGER'S PROJECT INSPECTION AND MONITORING RESULTS

Inspected by _____ Date_____

Type of Inspection (Annual) (Emergency) (Other)

1. PROJECT INSPECTION (DEFICIENCIES REQUIRE CORRECTION).

Item	Comment

a. Confined Dredged Material Placement Site

( ) Waste materials/unauthorized structures

b. Hydraulic Dredging

( ) Debris removal and placement (Little Denny entrance access control)
( ) Waste materials/unauthorized structures

c. Mechanical Excavation

( ) Debris removal and placement (Little Denny entrance access control
( ) Waste materials/unauthorized structures

d. Check Dams

( ) Waste materials/unauthorized structures

e. Pothole Creation

( ) Waste material/unauthorized structures

f. Revegetation

( ) Seedling condition
( ) Herbicide Treatment

2. PROJECT MONITORING (OBSERVATIONS AID PROJECT EVALUATION).

a. Hydraulic Dredging

( ) Development of emergent vegetation
( ) Fish stress or kills
( ) Waterfowl presence or absence

b. Mechanical Excavation

( ) Encroachment of bankline or obvious shoaling
( ) Development of emergent vegetation
( ) Fish stress or kills
( ) Waterfowl presence or absence

c. Pothole Creation

( ) Waterfowl presence or absence

d. Revegetation

( ) Seedling survival

_____
Site Manager

APPENDIX C

DISTRIBUTION

DISTRIBUTION:

Mr. Sam Marler
Regional Director, Region 3
U.S. Fish and Wildlife Service
Federal Building, Ft. Snelling
Twin Cities, MN 55111

Mr. Michael Bornstein
U.S. Fish and Wildlife Service
R.R. #1
Wapello, IA 52653

Mr. ~~Bob Stratten~~ Dick
U.S. Fish and Wildlife Service
Mark Twain National Wildlife Refuge
311 North 5th, Suite 100
Quincy, Illinois 62301

Mr. Tom Bell
U.S. Fish and Wildlife Service
Louisa Division
Mark Twain National Wildlife Refuge
R.R. #1, Box 75
Wapello, Iowa 52653

Rock Island Field Office
U.S. Fish and Wildlife Service
1830 Second Avenue
Rock Island, IL 61201

Environmental Management Technical Center
ATTN: Ms. Pam Thiel
575 Lester Drive
Onalaska, WS 54650

Mississippi Monitoring
ATTN: Rus Gent
206 Rose Street
Bellevue, IA 52031

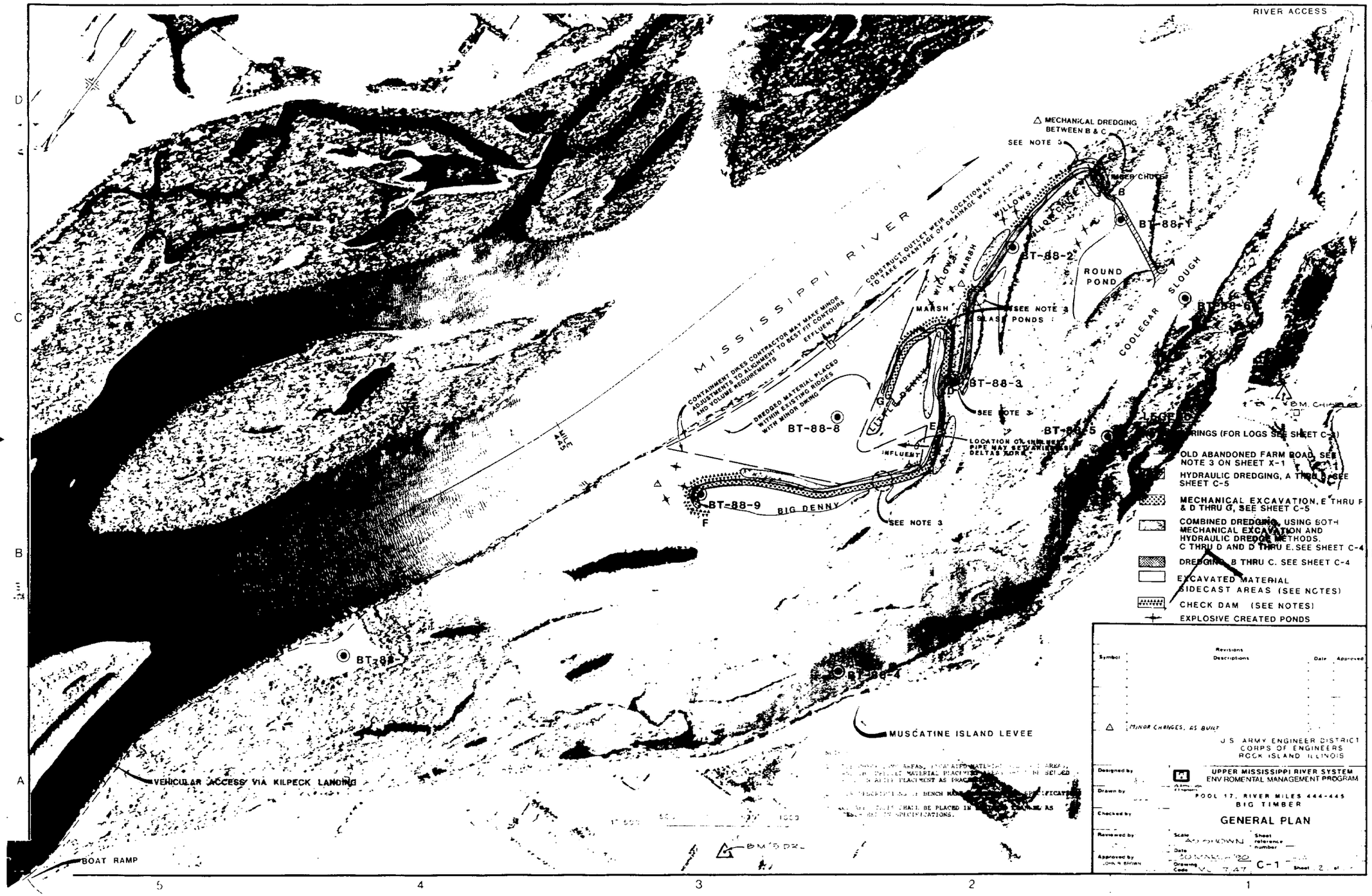
Ms. Holly Stoerker
Upper Mississippi River Basin Association
415 Hamm Building
408 St. Peter Street
St. Paul, MN 55111

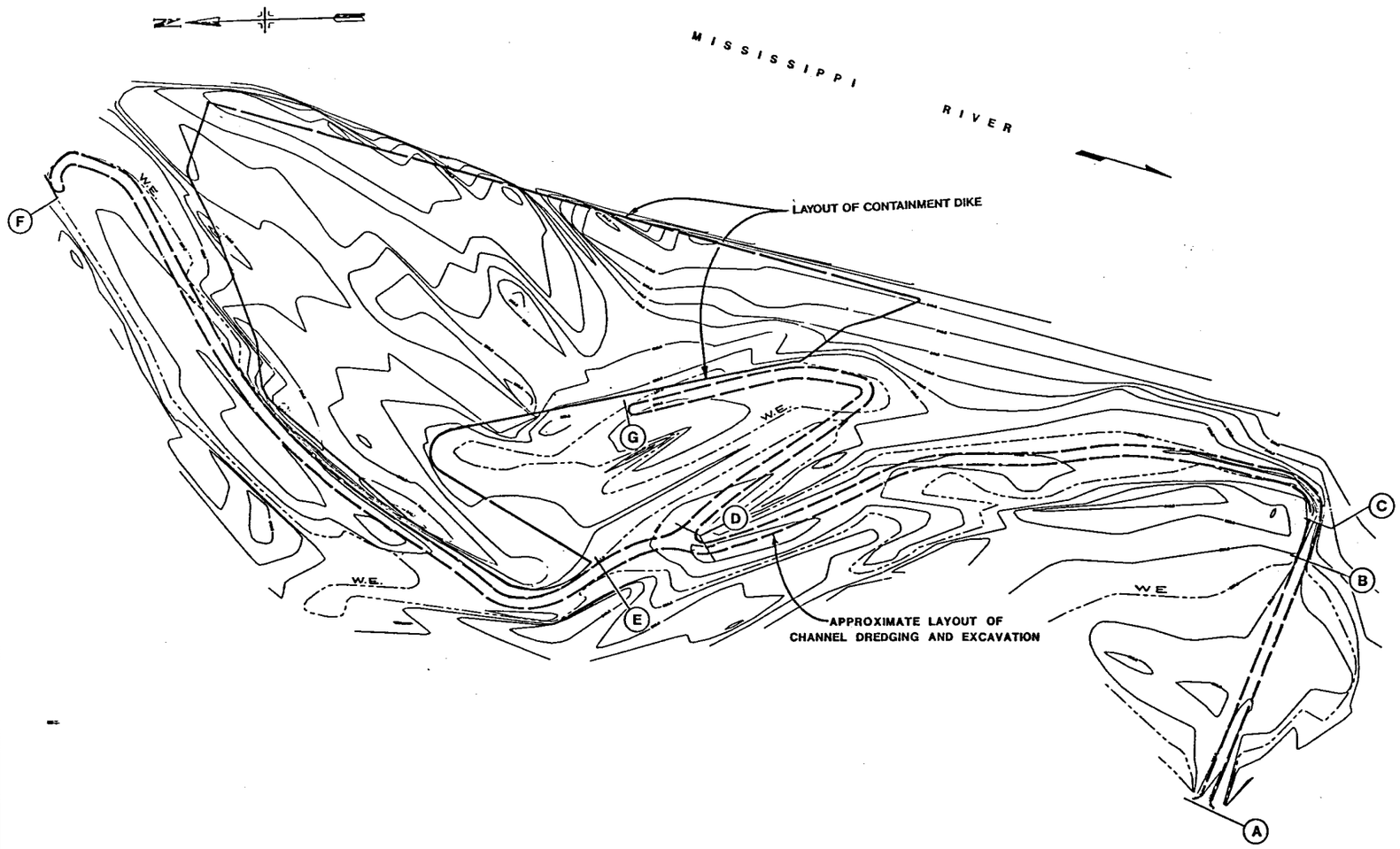
Mr. Kevin Szcondronski
Iowa Department of Natural Resources
Wallace State Office Building
Des Moines, IA 50319-0034

Division Engineer
U.S. Army Engineer Division, North Central
ATTN: CENCD-PD/CENCD-CO
539 South Clark Street
Chicago, IL 60605-1592

District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004
ATTN: CENCR-ED CENCR-ED-HQ
CENCR-ED-DN CENCR-PD-E
CENCR-ED-G CENCR-PD-W
CENCR-ED-H CENCR-OD-S
CENCR-ED-D CENCR-OD-R

1/ All addresses receive one copy of the document except where noted in parentheses.


RIVER ACCESS
MISSISSIPPI RIVER
MECHANICAL DREDGING BETWEEN B & C
SEE NOTE 5
BT-88-1
BT-88-2
BT-88-3
BT-88-4
BT-88-5
BT-88-6
BT-88-7
BT-88-8
BT-88-9
WILLOWS
MARSH
ROUND POND
COOLEGAR SLOUGH
BIG DENNY
SEE NOTE 3
SLASH PONDS
CONTAINMENT DIKES CONTRACTOR MAY MAKE MINOR ADJUSTMENTS TO ALIGNMENT TO BEST FIT CONTOURS AND VOLUME REQUIREMENTS
CONSTRUCT OUTLET WEIR LOCATION MAY VARY TO TAKE ADVANTAGE OF DRAINAGE WAY
EFFLUENT
INFLUENT
DREDGED MATERIAL PLACED WITHIN EXISTING RIDGES WITH MINOR DIKING
LOCATION OF SHORE PIPE MAY BE VARIED TO DELTAS WORK
BM. CHISEL
RINGS (FOR LOGS SEE SHEET C-3)
OLD ABANDONED FARM ROAD, SEE NOTE 3 ON SHEET X-1
HYDRAULIC DREDGING, A THRU F, SEE SHEET C-5
MECHANICAL EXCAVATION, E THRU F & D THRU G, SEE SHEET C-5
COMBINED DREDGING USING BOTH MECHANICAL EXCAVATION AND HYDRAULIC DREDGE METHODS. C THRU D AND D THRU E, SEE SHEET C-4
DREDGING B THRU C. SEE SHEET C-4
EXCAVATED MATERIAL SIDECAST AREAS (SEE NOTES)
CHECK DAM (SEE NOTES)
EXPLOSIVE CREATED PONDS
MUSCATINE ISLAND LEVEE
VEHICULAR ACCESS VIA KILPECK LANDING
BOAT RAMP
BM 202
Symbol
Revisions
Descriptions
Date
Approved
MINOR CHANGES, AS BUILT
U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND ILLINOIS
Designed by
Drawn by
Checked by
Reviewed by
Approved by
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 17, RIVER MILES 444-445
BIG TIMBER
GENERAL PLAN
Scale AS SHOWN
Date
Drawing Code
Sheet reference number C-1
Sheet 2 of



100 0 200 400 600 800 1000
SCALE IN FEET

DATE OF SURVEY: JULY 1988

DREDGING/EXCAVATION SCHEDULE

REACH	LENGTH IN FEET	BOTTOM WIDTH IN FEET		BOTTOM ELEVATION		CU. YARDS	CU. YARDS
		HYDRAULIC	MECHANICAL	HYDRAULIC	MECHANICAL	HYDRAULIC	MECHANICAL
A-B	1120	50	—	528	—	14,865	—
B-C*	327	39	—	528	—		5458
C-D	3200	50	40	528	532.5	47,709	23,377
D-E	750	50	40	528	532.5	11,184	5,587
E-F	3425	—	50	—	532.5	—	20,651
D-G	1850	—	50	—	532.5	—	12,577
TOTALS	10,872					73,757	69,224

Revisions			
Symbol	Description	Date	Approved
1	ADJUSTED ALIGNMENT, AS BUILT	21 OCT 91	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

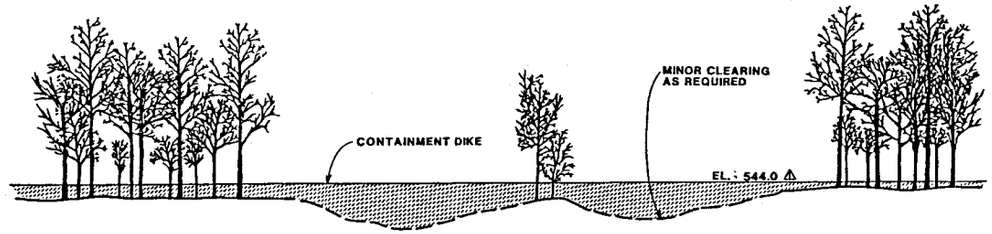
Designed by: REA
Drawn by: RMC
Checked by:
Reviewed by: CS
Approved by: JOHN E. BROWN, COL, CORPS OF ENGINEERS

US Army Corps of Engineers Rock Island District

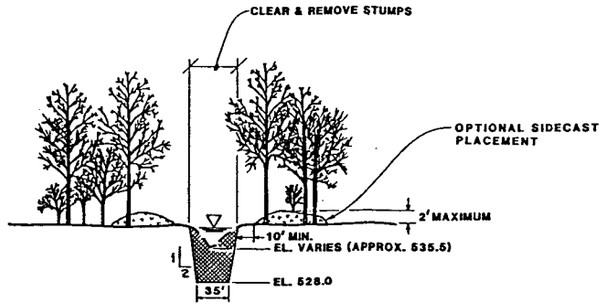
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 17, RIVER MILES 444-445
BIG TIMBER

DREDGING / EXCAVATION AND CONTAINMENT FACILITY PLAN

Scale: AS SHOWN
Date: 30 MARCH '90
Drawing Code: ML 17/4T
Sheet reference number: C-4
Solicitation Number: DACW 25-90-B-0031
Sheet 5 of 5

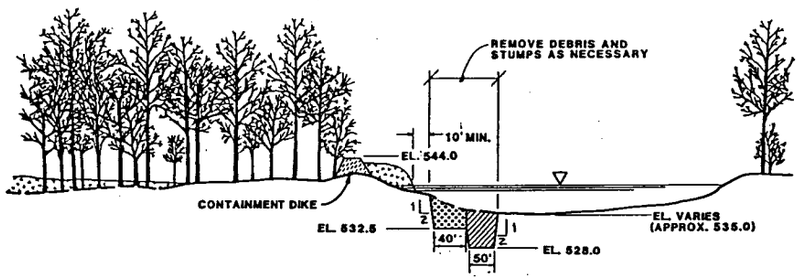


MINOR EARTH WORK TO SUPPLEMENT NATURAL BERM
TYPICAL ELEVATION



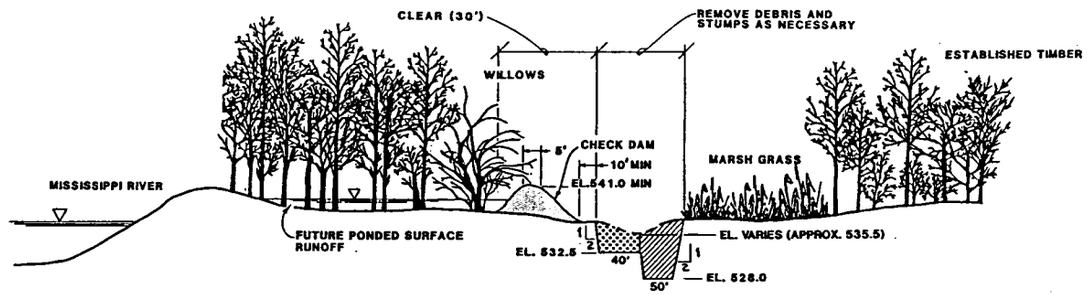
TIMBER CHUTE DREDGING
TYPICAL SECTION

B THRU C, SEE SHEET C-1



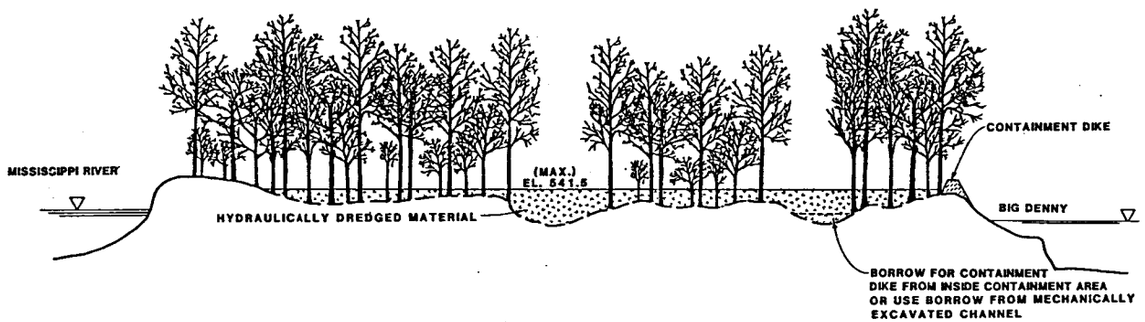
LAKE DREDGING TYPICAL COMBINATION SECTION △

D THRU E, SEE SHEET C-1



WILLOW CHUTE DREDGING
TYPICAL SECTION △

C THRU D, SEE SHEET C-1



NATURAL DREDGED MATERIAL PLACEMENT AREA
TYPICAL SECTION

LEGEND:

- HYDRAULIC DREDGE
- MECHANICAL EXCAVATION
- SIDECAST EXCAVATION AND HYDRAULICALLY DREDGED MATERIAL
- CHECK DAM FROM MECHANICAL EXCAVATION CHANNEL
- CONTAINMENT DIKE
- DREDGING OR EXCAVATION TO BE DETERMINED BY CONTRACTOR

Revisions			
Symbol	Descriptions	Date	Approved
△	SECTION AND ELEVATION CHANGES, AS BUILT	31 OCT 91	

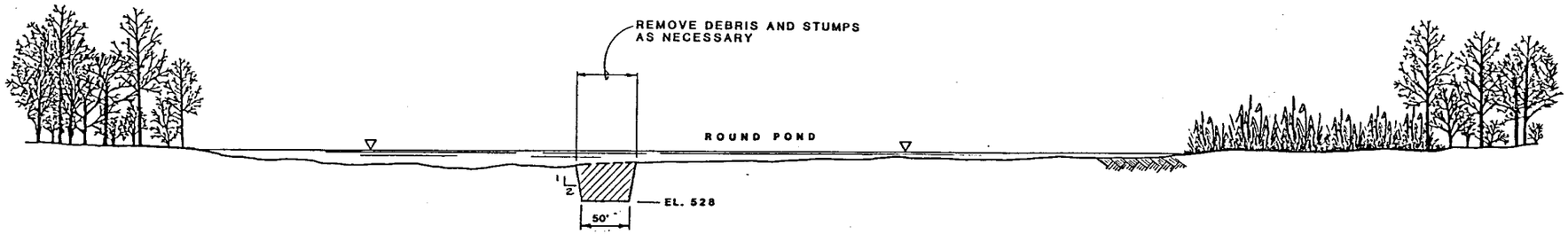
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by: REH
Drawn by: P.K.B
Checked by: [illegible]
Reviewed by: CS
Approved by: JOHN R. BROWN COL., CORPS OF ENGINEERS

UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM
US Army Corps of Engineers

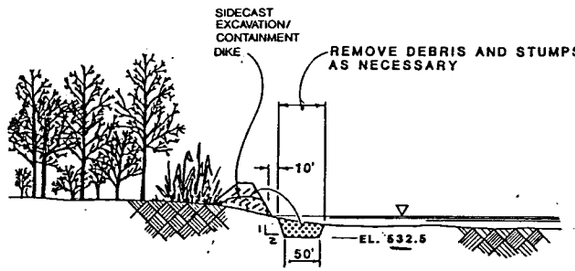
POOL 17, RIVER MILES 444-445
BIG TIMBER
SECTIONS I

Scales:
Dates: 20 MARCH 90
Drawing Code: ML 17/47
Sheet reference number: C-6
Solicitation No. DACW 25-90-B-0031
Sheet 7 of 8



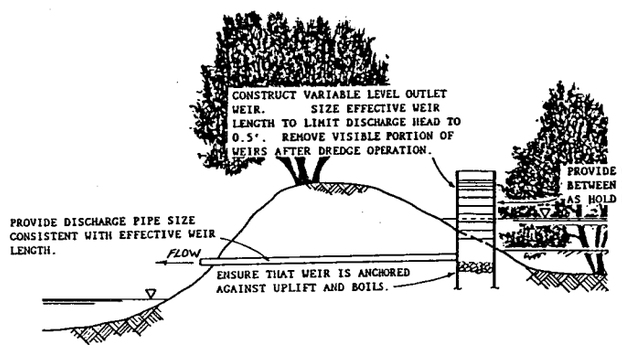
ROUND POND DREDGING, TYPICAL SECTION △

TYPICAL A-B SEE SHEET C-1

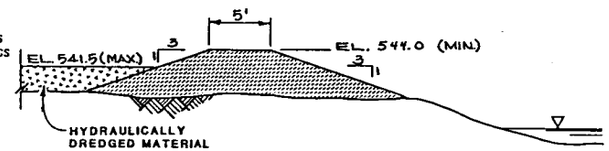


TYPICAL MECHANICAL EXCAVATION SECTION △

TYPICAL D-G AND E-F SEE SHEET C-1

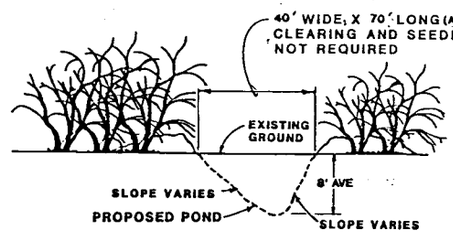


OUTLET WEIR SECTION



CONTAINMENT DIKE SECTION △

TYPICAL SECTION



EXPLOSIVE CREATED PONDS △

TYPICAL SECTION

LEGEND:

- HYDRAULIC DREDGING
- MECHANICAL EXCAVATION
- SIDECAST EXCAVATION AND HYDRAULICALLY DREDGED-MATERIAL
- CONTAINMENT DIKE

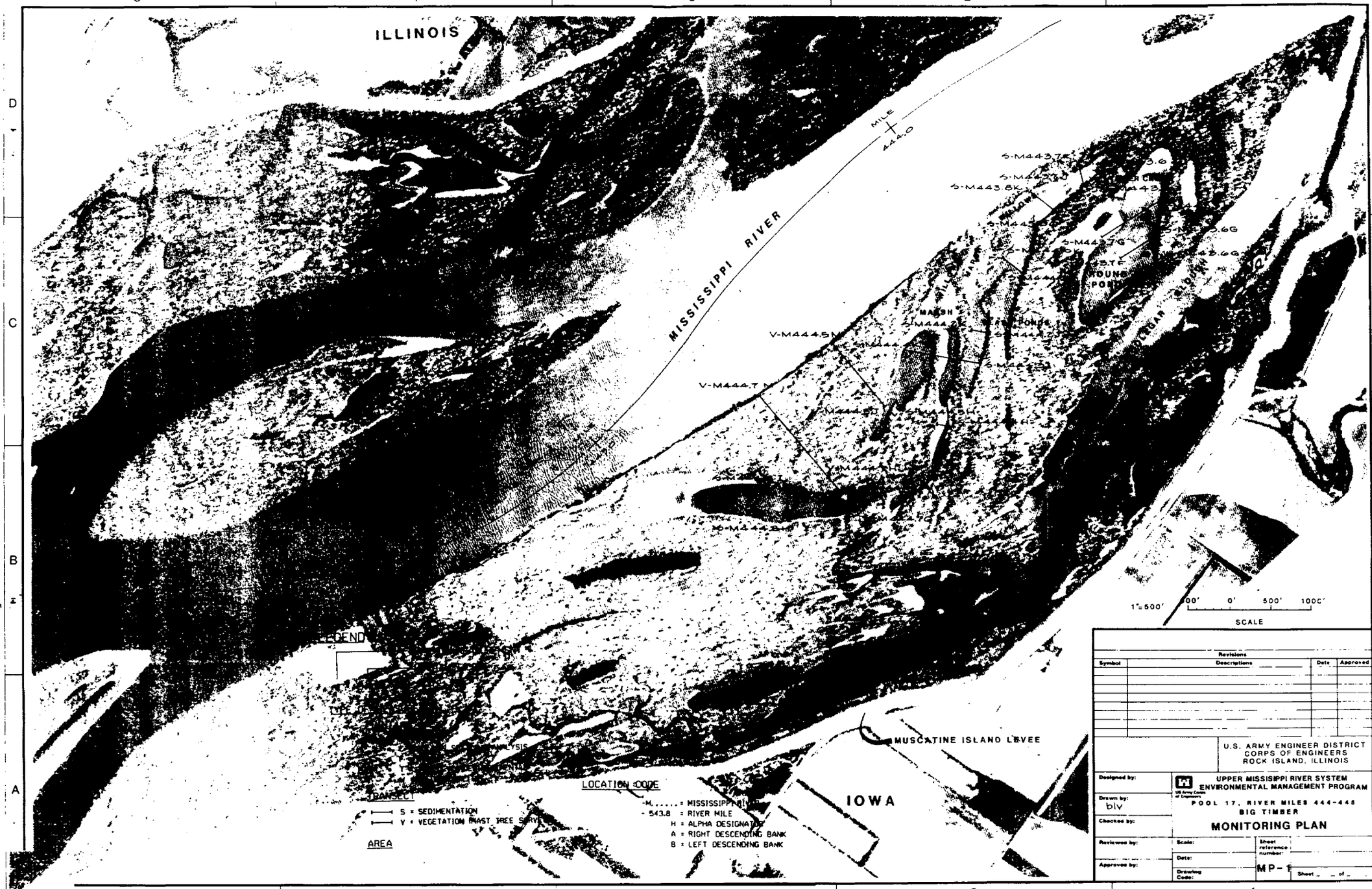
Revisions			
Symbol	Descriptions	Date	Approved
△	SECTION AND SCHEDULE CHANGES, AS BUILT	21 OCT 91	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 17, RIVER MILES 444-445
BIG TIMBER

SECTIONS II

Designed by: REH	Scale: NONE
Drawn by: DLV RKB	Date: 20 MARCH '90
Checked by:	Drawing Code: ML 17/4T
Reviewed by: CS	Sheet reference number: C-7
Approved by: JOHN R. BROWN, COL, CORPS OF ENGINEERS	Solicitation No. DACW 25-90-B-0031
	Sheet 8 of 8



Revisions			
Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by:
Drawn by: blv
Checked by:
Reviewed by:
Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 17, RIVER MILES 444-445
BIG TIMBER
MONITORING PLAN

Scale:
Date:
Drawing Code:
Sheet reference number: MP-1
Sheet _ of _